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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/471,173	12/23/1999	NARIHIRO MOROSAWA	0020-4652P	7107

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EXAMINER

QUINTO, KEVIN V

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 05/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/471,173

Applicant(s)

MOROSAWA ET AL.

Examiner

Kevin Quinto

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2 and 13-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 13, 16, 19 and 22 is/are allowed.
- 6) ☒ Claim(s) 2, 14, 15, 17, 18, 20, 21, and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☒ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other _____

NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800
Office Action Summary
NATHAN J. FLYNN

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed March 3, 2003 have been fully considered but they are not persuasive. The applicant states that the examiner "is asserting that a nitrogen atom concentration of more than $1 \times 10^{20} \text{ cm}^{-3}$ is somehow inherent in Mitani." The applicant also uses In re Robertson in support of this statement. However the inherency arguments of In Re Robertson do not appear to be on point with the reasoning provided by the examiner to combine the Mitani and Wristers references. The applicant has not provided adequate reasoning as to why Mitani cannot be combined with the nitrogen atom concentration of Wristers; thus the rejection stands. Newly amended claim 24 has overcome the rejection under 35 USC § 112. However claim 24 is still rejected under 35 USC § 103. As for the remarks made concerning unexpected results, it is known in the semiconductor art that boron penetration through the gate dielectric affects flat-band voltage (see Nayak et al., USPN 5,817,536, column 2, lines 62-67 and column 3, lines 1-7). This evidence leads the examiner to believe that the results discussed in the response are not unexpected.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 2, 14, 15, 17, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. (USPN 6,191,463 B1) in view of Wristers et al. (USPN 5,674,788).

4. In reference to claim 2, Mitani et al. (USPN 6,191,463 B1, hereinafter referred to as the "Mitani" reference) discloses a similar device. In claim 9 of Mitani (column 44, lines 9-19), a substrate is described with a gate electrode over a gate insulator. The gate insulator is composed of a combination of silicon, oxygen, nitrogen, and fluorine (a halogen element).

5. Mitani does not disclose the exact nitrogen atom concentration of the applicant (more than $1 \times 10^{20} \text{ cm}^{-3}$). However it is known in the semiconductor art that having a nitrogen atom concentration of this quantity in a gate insulator has the benefit of preventing the penetration of boron atoms into the gate insulator. This is disclosed by Wristers et al. (USPN 5,674,788, hereinafter referred to as the "Wristers" reference) in column 8, lines 2-6. Therefore it would be obvious to utilize a gate insulator having a nitrogen concentration greater than $1 \times 10^{20} \text{ atoms/cm}^2$ in the device of Mitani so as to attain the advantage of preventing boron penetration into the gate insulator.

6. It is the examiner's belief that the additional limitation "and flat band voltage is stable even if fluorine injection occurs" does not overcome the rejection of 35 USC § 103. The examiner believes that when "fluorine injection" is referred to in the claim, it is referring to the addition of fluorine in the gate insulator. The examiner believes that this is the intent of the applicant's invention; the presence of fluorine in the gate insulator

prevents the boron from going into the substrate. The device of Mitani already contains a fluorine concentration.

7. Regarding claim 14, the device of Mitani constructed in view of Wristers meets the claim. In claim 9 of Mitani, the fluorine concentration of the gate insulator is 1×10^{20} atoms/cm³ to 1×10^{21} atoms/cm³. This meets the limitation where the fluorine concentration is more than 1×10^{19} atoms/cm³.

8. Regarding claims 15, 17, 21 and 23; both Mitani and Wristers utilize boron doped polysilicon gates. In the device of Mitani constructed in view of Wristers, boron diffusion into the substrate is prevented by a gate insulator having a nitrogen concentration greater than 1×10^{20} atoms/cm².

9. In reference to claim 24, the device of Mitani constructed in view of Wristers meets this claim. In p.14 of the specification, the applicant states that the "addition of fluorine to the nitrided oxide having a nitrogen concentration of 1×10^{20} /cm³ reduced the deterioration of transconductance." The examiner is not certain as to whether or not the applicant is implying that a chemical reaction or bonding is taking place between the fluorine and the nitrogen. The examiner believes that the presence of fluorine is what reduces "the deterioration of transconductance" and not any chemical bonding between the fluorine and the nitrogen. The examiner believes that this additional limitation is not patentable over the combination of Mitani and Wristers because this limitation repeats a structural limitation already made in claim 2; that fluorine and nitrogen are present in the gate insulator.

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10. Claims 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. (USPN 6,191,463 B1) in view of Wristers et al. (USPN 5,674,788) as applied to claims 2 and 14 above, and further in view of Gardner et al. (5,851,888).

11. Regarding claims 18 and 20, neither Mitani nor Wristers discloses the exact thickness. However the use of thin gate dielectrics is well known in the art. Gardner et al. (USPN 5,851,888, hereinafter referred to as the "Gardner" reference) discloses a 3 nm nitrided gate insulator (claim 1). Such thin gate dielectrics are used for the advantage of reducing short channel effects (column 1, lines 30-32). It would therefore be obvious to construct the nitrided gate insulator of the device of Mitani constructed in view of Wristers with a thickness of 3 nm; which is between 0.5-5 nm.

Allowable Subject Matter

12. Claims 13, 16, 19, and 22 were allowed in a prior Office action.

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (703) 306-5688. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (703) 308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

KVQ
May 19, 2003